THAT WHICH IS CLAIMED IS:

1. Semiconductor device for electro-optic applications of the type including at least a rare-earth ions doped P/N junction integrated on a semiconductor substrate, a cavity or a waveguide and a coherent light source, characterised in that said coherent light source is obtained incorporating said rare-earth ions in the depletion layer of said P/N junction.

2. Semiconductor device according to claim 1, wherein said P/N junction is reverse biased.

3. Semiconductor device according to claim 1, wherein said rare-earth ions doped P/N junction is the base-collector region of a bipolar transistor.

4. Semiconductor device according to claim 1, wherein said rare-earth ions are Erbium ions.

5. Semiconductor device according to claim 1, wherein said cavity or waveguide includes said P/N junction and is partially enveloped by a protective layer having a lower dielectric constant with respect to said junction.

6. Semiconductor device according to claim 1, wherein a buried reflecting layer is provided to delimit the bottom of said waveguide.

7. Semiconductor device according to claim 1, wherein said semiconductor substrate is a SOI substrate.

8. Semiconductor device according to claim 1, wherein said semiconductor substrate is an epitaxial layer covering an heavily doped substrate layer.

9. Semiconductor device according to claim 1, wherein said cavity or waveguide has a rib elongated structure projecting from the semiconductor surface.

10. Semiconductor device according to claim 1, wherein said semiconductor is Silicon.

11. Semiconductor laser device comprising at least a rare-earth ions doped P/N junction integrated on a semiconductor substrate, a cavity or waveguide and a coherent light emitting source, characterised in that said device comprises includes a biasing device and incorporates said rare-earth ions in the depletion layer of said P/N junction.

12. Semiconductor laser device according to claim 10, wherein said biasing device is a bipolar transistor and said P/N junction is the base-collector region of said bipolar transistor.

13. Semiconductor laser device according to claim 10, wherein said P/N junction is reverse biased.

14. Semiconductor laser device according to claim 10, wherein said rare-earth ions are Erbium ions.

15. Semiconductor laser device according to claim 10, wherein said cavity or waveguide includes said P/N junction and is partially enveloped by a protective layer having a lower dielectric constant with respect to said junction.

16. Semiconductor laser device according to claim 10, wherein said cavity or waveguide has a rib elongated structure projecting from the semiconductor surface.

17. Semiconductor laser device according to claim 10, wherein said semiconductor substrate is a SOI substrate.

18. Semiconductor laser device according to claim 10, wherein said semiconductor substrate is an epitaxial layer covering an heavily doped substrate layer.

19. Semiconductor laser device according to claim 10, wherein a buried reflecting layer is provided to delimit the bottom of said waveguide.

20. Semiconductor laser device according to claim 10, wherein said semiconductor is Silicon.

21. A method for manufacturing a semiconductor device for electro-optic applications, said device including at least a rare-earth ions doped P/N junction integrated on a semiconductor substrate, characterised in that of providing a cavity or waveguide in said semiconductor substrate and a coherent light emitting source incorporating said rare-earth ions in the depletion layer of said P/N junction.

22. Method according to claim 21, wherein a biasing device is also provided to bias said P/N junction.

23. Method according to claim 21, wherein said biasing device is a bipolar transistor and said rare-earth ions doped P/N junction forms the base-collector region of said bipolar transistor.

24. Method according to claim 21, wherein said rare-earth ions are Erbium ions.

25. A method for manufacturing a semiconductor laser device for electro-optic applications, said device including at least a rare-earth ions doped P/N junction integrated on a semiconductor substrate, characterised in that of providing a cavity or waveguide in said semiconductor substrate and a coherent light emitting source comprising a biasing device and a concentration of said rare-earth ions in the depletion layer of said P/N junction.

26. Method according to claim 25, wherein said biasing device is a bipolare transistor and said rare-earth ions doped P/N junction forms the base-collector region of said bipolar transistor.

27. Method according to claim 25, wherein said rare-earth ions are Erbium ions.

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